FOREST DEVELOPMENT RESEARCH TRUST FUND

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The Hon. Don Sparrow
Minister of Forestry, Lands and Wildlife
403 Legislature Building
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Sir:

I have the honor to submit the Annual Report of the Forest Development Research Trust Fund for the fiscal year ending March 31, 1986.

Respectfully submitted,

J. Soos, Chairman
Advisory Council
Forest Development Research
Trust Fund

FOREWORD

There were five new and four renewed studies financed by the Forest Development Research Trust Fund during 1985/86 fiscal year.

One study pertaining to the field and greenhouse performance of white spruce edaphic ecotypes collected from areas having different calcium concentrations was completed.

The new studies cover a wide range of topics such as field evaluation of erosion hazard, freeze and thaw cycles of drained and undrained peatland, host effects on genetic behavior of mountain pine beetles, development of stem area growth model of lodgepole pine and white spruce and lichen regeneration in disturbed caribou winter habitat forests.

Good progress was made on all renewed studies. The antifungal substance maltol reduced the western gall rust infestation of lodgepole pine seedlings. Eight wapiti were trapped and instrumented. They moved to the black spruce/tamarack forest types and successfully avoided predation during winter. The study of the development of pheromones for use against mountain pine beetles was successful in the laboratory; however, field testing was inconclusive due to the collapse of the beetle population. The Armillaria study identified three biological species in Alberta.

It was encouraging to observe that two MSc theses were completed and three other studies provided thesis material for MSc and PHD degrees.

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COMPLETED PROJECTS

FIELD AND GREENHOUSE PERFORMANCE OF WHITE SPRUCE EDAPHIC ECOTYPES

INVESTIGATORS: Dr. D.J. Pluth, University of Alberta
Dr. B.P. Dancik, University of Alberta

NEW PROJECTS

FIELD EVALUATION OF AN EROSION HAZARD ASSESSMENT IN WEST CENTRAL ALBERTA

INVESTIGATOR: Dr. R.L. Rothwell, University of Alberta

DURATION: Two years

OBJECTIVES: To assess the validity of erosion hazard system prediction developed by T. Singh with special reference to logging and road construction in the Hinton-Edson area.

PROGRESS: A total of 54 plots were established in 18 cutblocks representing two soil associations, two vegetation types, three replications with three sampling units. Each plot 1.2 x 3.0 m in size was cleared to the mineral soil and a grid of pins was installed at a spacing of 60 x 60 cm. The pins were set flush with the ground surface with a washer. Soil samples were collected from the upper 10 cm and were analysed for texture and carbonate Ca, Mg and organic content. Non recording rain gauges were installed in each study area for the assessment of precipitation effects on erosion. Precipitation was 362 mm for the growing season which was close to the long-term average of 390 mm. Inspection conducted in September revealed signs of erosion; however, soil losses were highly variable, ranging 0-8 mm between individual pins. Soil losses on plots are averaged and expressed as a volume loss. Preliminary assessment data indicated that a measurable erosion occurred.

FUTURE WORK: Study will continue for another field season. Observations will be improved by the installation of collection troughs on the lower edges of plots. Rainfall simulator will be tested in some soil associations.

FREEZE THAW CYCLES ON A DRAINED AND UNDRAINED BOREAL WETLAND SITE

INVESTIGATOR: Dr. R.L. Rothwell, University of Alberta

DURATION: Two years

OBJECTIVES: To evaluate the effects of peatland drainage on the freeze and thaw cycles and frost depth in the boreal zone of Central Alberta.

PROGRESS: Sampling transects were established in the undrained and drained areas with 40 m and 25 m ditch spacing. When frost conditions allowed, thermocouples were installed at depths of 10, 20, 40 and 60 cm below the ground surface and bi-weekly observations were carried out between May and the end of September. Continuous monitoring of soil temperatures at 10 cm and 30 cm depth was conducted by using thermistors with a digital data logger. It was found that frost recession was most rapid in the undrained area. Thermistor and thermocouple readings indicated that soil temperatures below 10 cm were colder throughout the drained area than the undrained area for most of the summer. In August, midday soil mean temperatures of 10-12°C were recorded at 20 cm in the undrained areas while in the drained area temperatures at the same depth were 6°-8°C. Diurnal soil temperature fluctuations were more pronounced in the drained area with daily amplitudes of 20°C and 4°C at 10 cm depth in the drained and undrained areas respectively. It is suggested that the drained surficial peat acted as insulating layer which inhibited heat gain and maintained frozen zone much longer than undrained peat.

FUTURE WORK: Study will be extended for one more field season to obtain a complete cycle of frost advance and recession.

HOST EFFECTS ON GENETICS AND BEHAVIOUR OF THE MOUNTAIN PINE BEETLE

INVESTIGATOR:	Dr. J.R. Spence, University of Alberta D.W. Langor, University of Alberta
DURATION:	Three years
OBJECTIVES:	To determine if host preference is resulting in genetic differentiation of local mountain beetle population and if such genetic variation is correlated with differences in beetle population dynamics, beetle size and attractiveness to host volatiles and beetle-produced pheromones.
PROGRESS:	Beetles were collected from adjacent populations of lodgepole pine and limber pine stands from two locations in the Porcupine Hills. Electrophoretic protocols have been worked out for 22 enzyme systems of which 10 show variation in mountain pine beetles. Rearing experiments were initiated to determine the heritability of electrophoretic loci and brood survivorship in different hosts. Studies are in progress to evaluate the response of beetles produced in both lodgepole pine and limber pine to all four possible combinations of host odors and beetle pheromones.
FUTURE WORK:	Mountain pine beetle specimens collected will be measured and subjected to morphometric analyses. Rearing of second generation beetles will be carried out and the evaluation of beetle response to host odors will be continued.

DEVELOPMENT OF A STEM AREA GROWTH MODEL FOR LODGEPOLE PINE AND WHITE SPRUCE IN ALBERTA

INVESTIGATOR	Dr. S.J. Titus, University of Alberta M.A. Clyde, University of Alberta
DURATION:	Two years
OBJECTIVES:	To develop a stem area growth model which provides individual tree volume growth for lodgepole pine and white spruce; to relate coefficients of the stem area growth model to stand characteristics and environmental variables; to evaluate the capability of existing taper, height growth and diameter models for stem area and volume growth.
PROGRESS:	A computer hardware and software were developed for the Tree Ring Measurement System. An article on this topic was submitted to the Forestry Chronicle. Diameter increments on discs taken from 80 trees were measured by using Tree Ring Measurement System. Taper equations were developed for the predicted and measured diameter increments and the variation with age and height along the stem for different crown classes and species was determined. A model was developed for diameter increment as a function of age and height along the stem.
FUTURE WORK:	Preparation of a MSc thesis and publication of several papers related to the project.

LICHEN REGENERATION IN DISTURBED CARIBOU WINTER HABITAT FORESTS

INVESTIGATOR: Dr. J. Snyder,
Grande Prairie Regional College

DURATION: Two years

OBJECTIVES: To determine the rate of growth and time required for terrestrial and arboreal lichens following disturbance in common forest types used by caribou in West-Central Alberta.

PROGRESS: Four stands with different ages were sampled and described in terms of terrestrial and arboreal lichen biomass considered available to caribou. Results showed that although arboreal lichen biomass was greater in older forests this was not necessarily true for terrestrial lichens. The highest terrestrial lichen production occurred in a 50-year-old stand. Observations indicated that among the four stands selected the 260-year-old stand was used more extensively by caribou during winter although more terrestrial lichen was available in the 50-year-old stand.

FUTURE WORK: A final report will be prepared and submitted.

RENEWED PROJECTS

ISOLATION AND CHARACTERIZATION OF ANTIFUNGAL SUBSTANCE(S) PRODUCED BY SCYTALIDIUM UREDINICOLA, A HYPERPARASITE OF ENDOCRONARTIUM HARKNESSII, WESTERN GALL RUST

INVESTIGATOR: Dr. M.A. Pickard, University of Alberta

DURATION: Four years

OBJECTIVES: To determine the ability of compound(s) produced by S. uredinicola to inhibit the germination of E. harknessii spores in vitro, and to isolate and purify the active compounds. The effectiveness of the compounds will be tested in vivo against western gall rust on lodgepole and jack pine as means of biological control.

PROGRESS: Basic studies were related to maltol production by Scytalidium uredinicola in malt extract broth, scaled up in a 10 L fermenter. A single "one shoot" experiment was carried out in collaboration with Dr. Blenis to find out the success of maltol application for the reduction of western gall rust infection of lodgepole pine seedlings. Results revealed that maltol applied to the soil at 20 mg rate reduced the infection rate by 40%, and was absorbed by the roots of lodgepole pine seedlings and translocated to the needles where infection occurred. Forty samples of lodgepole branches were collected from western gall rust infested and "resistant" trees for the determination of maltol content. Results showed that maltol concentrations of needles were similar for infected and "resistant" trees, therefore maltol concentration cannot be used as an index for the determination of western gall rust resistance.

FUTURE WORK: Research has been completed and a MSc thesis was prepared and successfully defended.

CRITICAL RESOURCES OF WAPITI IN THE BOREAL FOOTHILLS REGION OF ALBERTA

INVESITGATORS: Dr. R.J. Hudson, University of Alberta
C.D. Olsen, University of Alberta

DURATION: Three years

OBJECTIVES: To determine the seasonal ecological strategies of boreal wapiti with emphasis on the description of occupational patterns and foraging behavior; to identify critical habitat and forage resources and to assess the contribution of reclamation habitat to the seasonal nutrient cycle.

PROGRESS: Eight wapiti were trapped, immobilized, instrumented and released. These animals were followed through the summer of 1985. A solid data base concerning daily location and movements has been established since the capture of each animal. Wapiti were observed foraging on litter in aspen forests at the time of first snowfall; however they moved to black spruce/tamarack lowland forests when more snow was accumulated. Observations show that wapiti preferred this forest type during winter and were able to avoid predation. A total of five 24-hour activity scans were obtained at temperatures as low as -37°C. Forage and fecal samples were collected and stored for analysis.

FUTURE WORK: Field observations will be continued, data analysis and preparation of final report will be completed.

CHEMICAL COMMUNICATION (PHEROMONE) SYSTEM OF MOUNTAIN PINE BEETLE AND APPLICATION OF THE NATURAL PHEROMONE AND SYNTHETIC ANALOGS IN BEETLE MANAGEMENT

INVESTIGATOR: Dr. H. Wieser, University of Calgary
Dr. E.A. Dixon, University of Calgary

DURATION:

OBJECTIVES: To evaluate the response of beetles to various structurally related synthetic analogs of beetle-produced compound; to determine if any analogs tested provide a more potent attractant; to determine whether sex ratio shifts in favor of male or female; and to find relationship between molecular structure and attractive response for beetles in the field.

PROGRESS: A plan was made for the testing of a mimic chemical (7-methyl analog) similar to exo-brevicomin in two isomeric forms which are chemically identical. However, field bioassays failed owing to the virtual collapse of mountain pine beetle population in the test area. A novel method to produce isomeric forms was not only successful for exo-brevicomin, but also for the mimic chemical. As a result, synthesis of the mimic chemical is possible for operational use because of low production costs. Although spruce beetles (Dendroctonus rufipennis) normally colonize windblown trees and remain endemic, light mortality caused by them was observed at several locations in Alberta. Several pheromones developed for spruce beetles were tested in the Manning area. Results of this pilot project showed that currently accepted pheromones blends were not successful there and there is a need for the development of an effective pheromone and appropriate strategies in Alberta.

FUTURE WORK: Positive and negative isomers of exo-brevicomin and 7-methyl analogs will be tested in conjunction with other components such as myrcene and trans-verbenol against mountain pine beetles. New pheromone blends for spruce beetles will be tested in the Manning area.

PATHOLOGICAL AND PHYTOCHEMICAL STUDIES OF ARMILLARIA ROOT ROT OF INTENSIVELY MANAGED YOUNG CONIFEROUS FORESTS IN ALBERTA

INVESTIGATOR: Dr. Y. Hiratsuka, University of Alberta

DURATION: Three years

OBJECTIVES: To determine whether the weakening of the tree is necessary for disease expressions; to identify the possibility of a relationship between pathogen and disease distribution in several selective sites; to study the pathogenesis of the disease; and to identify biologically active metabolites produced by the pathogen.

PROGRESS: A total of 70 Armillaria root rot samples was collected from various locations in Alberta. The identification of samples revealed that there are three biological species in Alberta. Two biological species were associated with conifers, the third was found on non-coniferous hosts in the northern part of the province. An improved inoculation technique was developed to carry out pathogenicity tests with various biological species of Armillaria in container grown coniferous seedlings. A trial was established near Hinton to find out the relative trapping efficiency of aspen and lodgepole pine poles which were pounded into the ground.

FUTURE WORK: Since several biological species of Armillaria mellea complex were identified, pathogenicity related to various species will be investigated under different soil conditions.

FOREST DEVELOPMENT RESEARCH TRUST FUND

FINANCIAL STATEMENTS

MARCH 31, 1986

Auditor's Report

Balance Sheet

Statement of Revenue, Expenditure and Unexpended Funds

Notes to the Financial Statements

ALBERTA LEGISLATURE

OFFICE OF THE AUDITOR GENERAL

AUDITOR'S REPORT

To the Council of the Forest Development
Research Trust Fund

I have examined the balance sheet of the Forest Development Research Trust Fund as at March 31, 1986 and the statement of revenue, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1986 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Donald D. Salmon

C.A.
Auditor General

Edmonton, Alberta
July 16, 1986

FOREST DEVELOPMENT RESEARCH TRUST FUND

BALANCE SHEET

AS AT MARCH 31, 1986

	1986	1985
ASSETS		
Current:		
Cash	$178,225	$191,572
LIABILITIES		
Current:		
Research grants payable	$ 61,535	$ 64,871
Accounts payable	575	575
Unexpended funds	116,115	126,126
	$178,225	$191,572

The accompanying notes are part of these financial statements.

FOREST DEVELOPMENT RESEARCH TRUST FUND

STATEMENT OF REVENUE, EXPENDITURE AND UNEXPENDED FUNDS

FOR THE YEAR ENDED MARCH 31, 1986

	1986	1985
REVENUE		
Contributions by the Province of Alberta (Note 3)	$100,000	$100,000
Interest	18,300	22,812
Donations	115	-
	118,415	122,812
EXPENDITURE		
Research grants	127,851	139,698
Council members' fees and expenses	575	575
	128,426	140,273
Excess of expenditure over revenue	10,011	17,461
Unexpended funds at beginning of year	126,126	143,587
Unexpended funds at end of year	$116,115	$126,126

FOREST DEVELOPMENT RESEARCH TRUST FUND

NOTES TO THE FINANCIAL STATEMENTS

MARCH 31, 1986

Note 1 Authority

The Forest Development Research Trust Fund operates under the authority of the Forest Development Research Trust Fund Act, Chapter F-13, Revised Statutes of Alberta 1980.

Note 2 Significant Accounting Policies and Reporting Practices

Administration Expenses

Salaries, accommodation, and other overhead costs incurred in the administration of the Fund have been paid by the Province of Alberta and are not reflected in these financial statements.

Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3 Contributions by the Province of Alberta

The Department of Forestry, Lands and Wildlife provides contributions annually for research and council members' expenditure incurred by the Fund. Where expenditure is less than the contributions in any given year, the balance is repayable to the General Revenue Fund of the Province.

Note 4 Commitments

As at March 31, 1986, the Fund had research grant commitments totalling $112,235 (1985 $136,869).

Note 5 Approval of Financial Statements

These financial statements were approved by management.